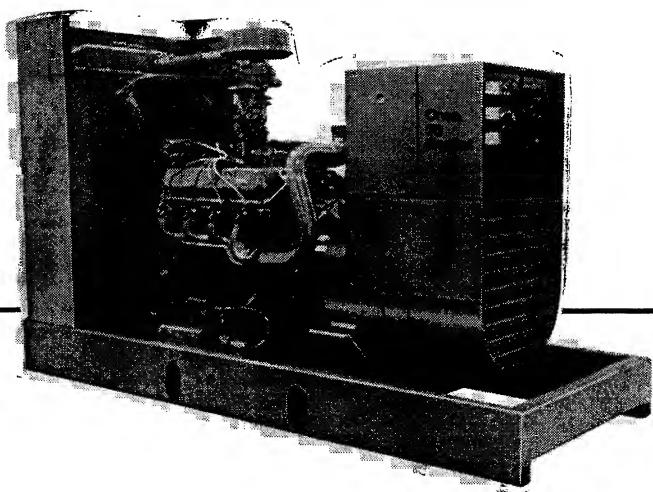


Onan

**Operator's
Manual**

EN

GenSets



928-0126

9-87

Printed in U.S.A.

Supplement 928-1010

Date: 11-88

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Title: EN Operator's Manual (9-87)

Number: 928-0126

Supplement

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Goldenveld

The following supplement covers the ENT generator set Operators Manual covered in the EN Operator set **except** where the ENT uses the same

75 EN series generator set

EN series generator set and shares many of the same engine components. The engine used in the ENT is basically a turbocharged, gaseous fueled version of the engine used to power the EN series generator set. A natural gas fuel system is standard, while an LPG fuel system or combination fuel system is available as an option.

Use these specifications for model ENT on page 3.

Specifications - 75 ENT

GENERATOR DETAILS

Type	Revolving Field, 4-Pole, Brushless
Rating (60 Hz Continuous Standby)	75 kW (93.75 kVA at 0.8 PF)
AC Voltage Regulation	±2%
Phase	3

ENGINE DETAILS

Engine	Ford CSG 875-6005A
Engine Speed	1800 RPM
Fuel (Standard)	Natural Gas
Fuel Inlet Thread Size	
Natural Gas	1 inch NPT Internal
LPG Liquid	1/4 inch NPT Internal
Propane Gas (Optional)	3/4 inch NPT Internal
Exhaust Outlet	
Turbocharger Outlet	2-1/2 inch NPT Internal
Silencer Outlet (Optional)	4 inch NPT External
Starting System Voltage	12
Battery Requirements	
BCI Group	3EE
Capacity	72 ah (259 kC)
Quantity	1
Cooling System Capacity (Engine and Radiator)	31 Quarts (29 L)
Engine Oil Capacity (Including Filter)	6.5 Quarts (6.2 L)

TUNE-UP SPECIFICATIONS

Use the following specifications even if different from the recommendations in the engine manufacturer's manual.	
Spark Plug Type	ASF 32M
Spark Plug Torque	10 to 15 Ft-Lbs (14 to 20 N•m)
Spark Plug Gap	0.035 Inch (0.89 mm)
Ignition Point Gap	0.017 Inch (0.43 mm)
Ignition Timing	40° BTC at 1800 RPM
Valve Lash	Zero Lash

Use this operation section in place of existing Operation section beginning on page 4 for both EN and ENT models. Basic difference is that both models now use the Detector 7 control as standard.

Operation

GENERAL

This section covers prestart checks, starting and stopping and operating the generator set. It is recommended each operator should read through this entire section before attempting to start the set. It is essential that the operator be completely familiar with the set for safe operation.

PRESTART CHECKS

Before starting, be sure the following checks have been made and the unit is ready for operation. Refer to the MAINTENANCE section for the recommended procedures.

Lubrication

Check the engine oil level. Keep the oil level near as possible to the dipstick high mark without overfilling.

Coolant

Check the engine coolant level. The coolant should be about two inches below the radiator cap opening. Do not check while the engine is hot.



Contact with hot coolant can result in serious burns. Do not bleed hot, pressurized coolant from a closed cooling system.

Fuel

Make sure the fuel tanks have sufficient fuel and fuel system is primed. See the MAINTENANCE section for recommended fuel.

CONTROL PANEL

The following describes the function and operation of the standard Detector 7 and optional Detector 12 generator set control. All instruments and control switches are located on the face of the control panel as illustrated in Figure 2. The control panel is separated into a DC panel for monitoring the engine and an AC panel for monitoring the generator.



EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- **Dizziness**
- **Nausea**
- **Headache**
- **Weakness and Sleepiness**
- **Throbbing in Temples**
- **Muscular Twitching**
- **Vomiting**
- **Inability to Think Coherently**

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

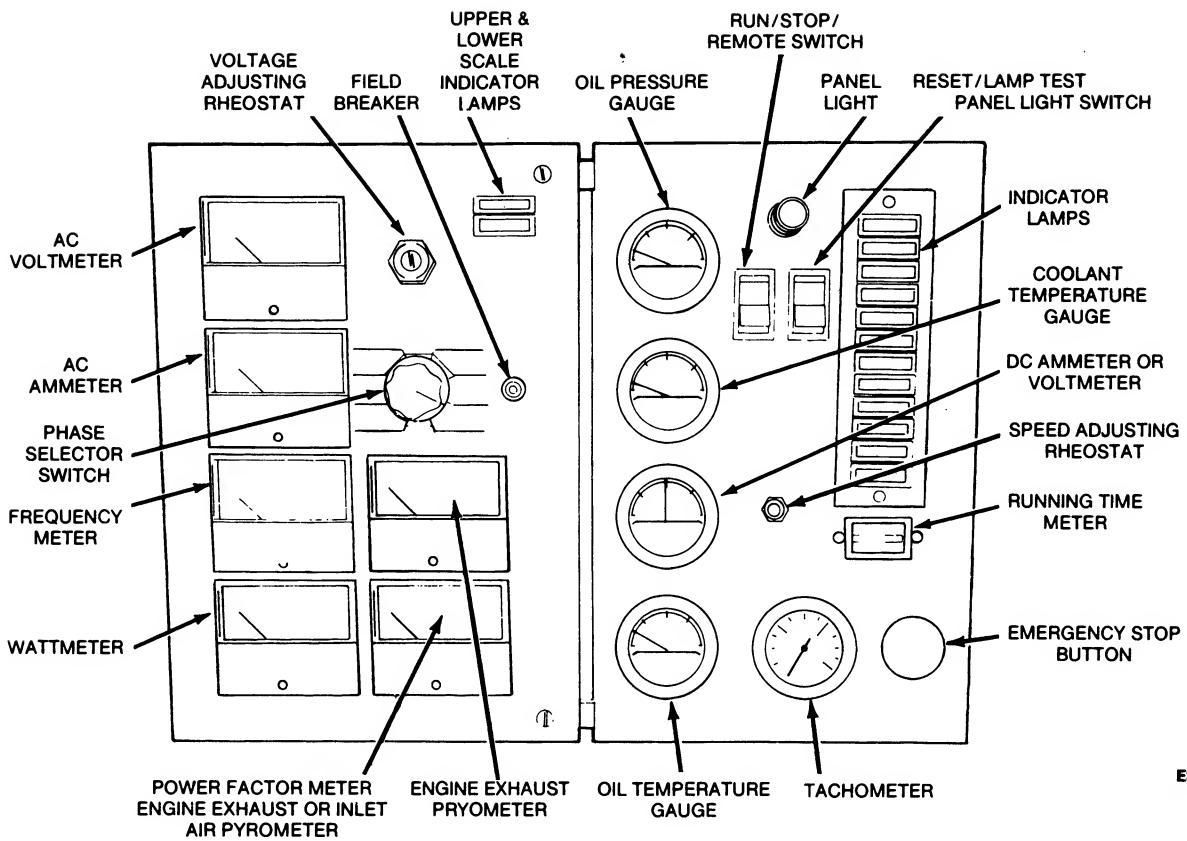


FIGURE 2. DETECTOR 12 CONTROL PANEL

ES-1800

DC Panel

Panel Lamp: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Coolant Temperature Gauge: Indicates temperature of circulating coolant in engine (wired to a sensor unit located on the engine).

DC Voltmeter: Indicates the battery charging system voltage.

Run/Stop/Remote Switch: Starts and stops the unit locally, or from a remote location wired to the control engine monitor board.

Running Time Meter: Registers the total number of hours the unit has run. Use it to keep a record of periodic servicing. Time is cumulative; meter cannot be reset.

Reset/Lamp Test/Panel Lamp Switch: Resets the fault circuit only when the Run/Stop/Remote switch is in the Stop (Reset) position. Tests fault lamps and turns on the control panel lamp.

Tachometer (Optional): Provides constant monitoring of engine r/min.

Speed Adjusting Rheostat (Optional): Used in conjunction with an optional electronic governor to adjust engine speed.

Oil Temperature Gauge (Optional): Indicates temperature of lubricating oil in engine (wired to a sensor unit located on the engine).

Emergency Stop Button (Optional): Push-in switch for emergency shut down of the engine.

Detector 7-Indicator Lamps: The standard control panel has seven indicator lamps which are described as follows:

- **RUN** (green) lamp comes on when both starter circuits are opened after unit starting.
- **PRE LO OIL PRES** (yellow) indicates engine oil pressure is marginally low.
- **PRE HI ENG TEMP** (yellow) indicates engine temperature is marginally high.
- **LO OIL PRES** (red) indicates engine has shut down because of critically low oil pressure.
- **HI ENG TEMP** (red) indicates engine has shut down because of critically high temperature.
- **OVERSPEED** (red) indicates engine has shut down because of excessive speed.
- **OVERCRANK** (red) indicates engine has shut down because of a failure to start during the cranking period.

Detector 12-Indicator Lamps: The optional twelve-lamp control version included all features of the seven-lamp version plus the following:

- FAULT 1 (red) an undedicated fault. May be factory programmed as a shutdown or non-shutdown, and as a timed or non-timed fault (normally set for timed shutdown).
- FAULT 2 (red) Same features as Fault 1 (normally set for timed shutdown).
- LOW ENG TEMP (yellow) engine temperature is marginally low for starting. Indicates inoperative coolant heater.
- LO FUEL (yellow) indicates fuel supply is marginally low.
- SWITCH OFF (flashing red) indicates generator set is not in automatic start operation mode.

CAUTION

Yellow lamps indicate potential problems that could damage the genset. Refer to Troubleshooting, Table 2.

AC Panel

AC Voltmeter (Optional): Dual range instrument indicating AC voltage. Measurement range in use shown on indicator light.

AC Ammeter (Optional): Dual range instrument indicates AC generator line current.

Wattmeter (Optional): Continuously gives reading of the generator output in kilowatts.

Power Factor Meter (Optional): Indicates percent power factor of AC output.

Frequency Meter (Optional): Indicates generator output frequency in hertz. It can be used to check engine speed (each hertz equals 30 r/min).

Voltage Adjusting Rheostat (Optional): Provides approximately plus or minus five percent adjustment of the rated output voltage.

Upper and Lower Scale Indicator Lamps (Optional): Indicates which scale to use on the AC voltmeter and ammeter.

Phase Selector Switch (Optional): Selects phases of generator output to be measured by AC voltmeter and AC ammeter.

Engine Pyrometers (Optional): Indicate engine exhaust and inlet air temperatures.

Field Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of generator, exciter and voltage regulator.

CONTROL PANEL INTERIOR

Generator AC Voltage Regulator

The solid-state regulator (VRAS-2) controls AC output voltage from the generator at a predetermined level regardless of load. Voltage regulation is plus or minus two percent from no load to full load. Random voltage variation is plus or minus one percent for constant loads.

Engine Control Module

Electronic and relay components of the engine monitoring circuit are on a circuit board assembly. Sensor inputs (Figure 4) are connected by the wiring harness to plug connectors on the board. The control module shuts down the engine under any of the following conditions.

- Overcrank - Limits engine cranking to 75 seconds. If engine fails to start, the module lights a fault lamp and opens the cranking circuit. The cycle cranking option allows three 15-second cranking cycles with two 15-second rest periods on the 12-lamp control.
- Overspeed - Shuts down the engine immediately if overspeed occurs and lights a fault lamp. The sensor switch is mounted in the end bell on the generator shaft. It is factory adjusted to shut down 60 hertz units at 2100 ± 90 r/min, 50 hertz units at 1850 ± 50 r/min.
- Low Oil Pressure - Shuts down the engine immediately if oil pressure drops below 25 psi (172 kPa) and lights a fault lamp. The fault is time-delayed about 10 seconds following starter disconnect and inhibited during cranking. The delay allows oil pressure to rise to normal before the electronic control module monitors this system.

A pre-low oil pressure sensor and lamp provides an alarm that oil pressure is marginally low, 30 psi (207 kPa) or less. The cause should be found and corrected as soon as possible.

- High Engine Temperature - shuts down the engine immediately if coolant temperature rises above 215°F (102°C) and lights a fault lamp. The fault is time-delayed about 10 seconds following starter disconnect and inhibited during cranking. This delay allows coolant in a hot engine time to circulate and return the water jacket to normal before the electronic control module monitors this system.

A pre-high engine temperature sensor and lamp provides an alarm that engine temperature is marginally high, 205°F (97°C). The cause should be found and corrected as soon as possible.

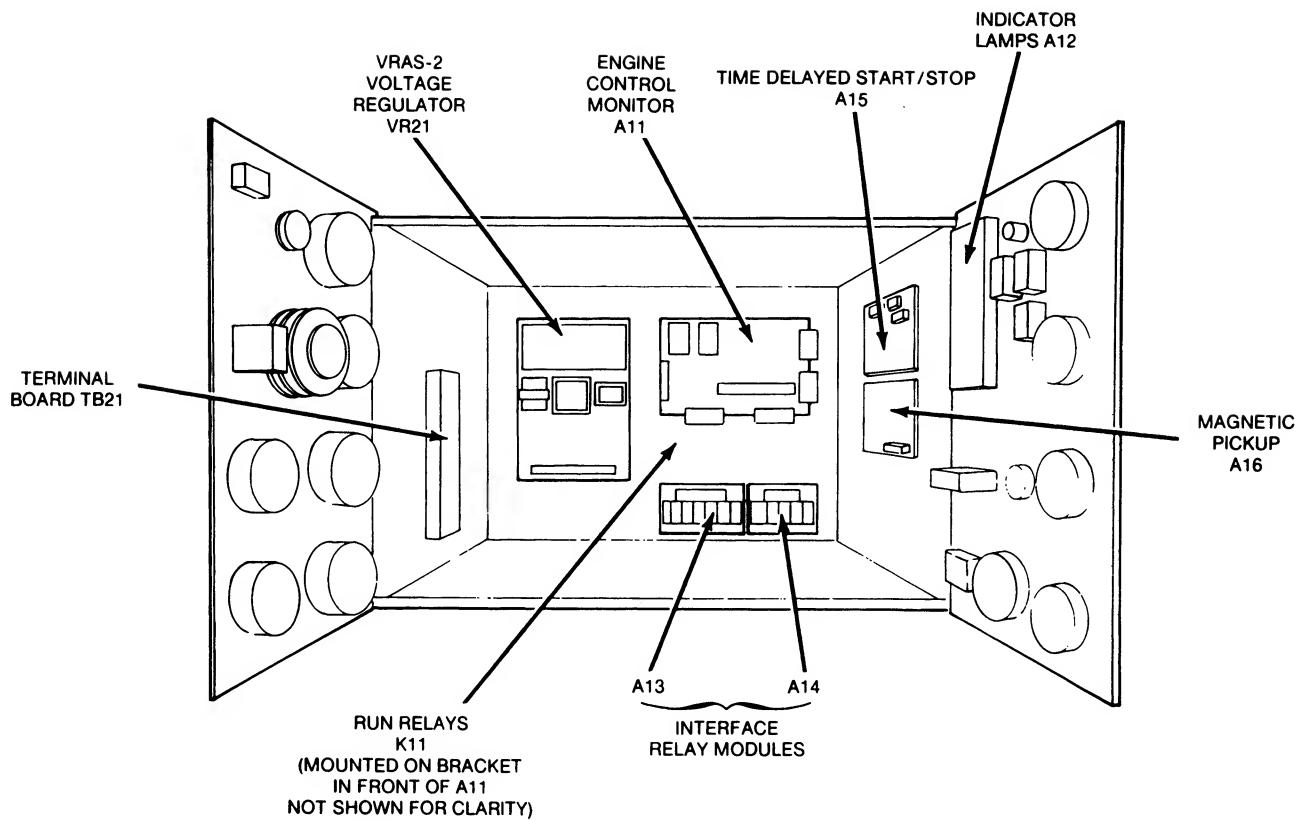


FIGURE 3. CONTROL PANEL INTERIOR

CAUTION

The high engine temperature shutdown system will not operate if the coolant level is too low. The high engine temperature sensor monitors coolant temperature. Loss of coolant will prevent sensor operation and allow the engine to overheat causing severe damage to the engine. Therefore, maintain adequate coolant level for proper operation of the high engine temperature shutdown system.

- Low Coolant Level Shutdown (Optional) - A submerged sensor in the top portion of the radiator shuts down the engine and lights the Hi Engine Temp fault lamp when the coolant level falls below the level of the sensor.

STARTING

The following sections cover the three systems used to start the generator set.

Starting at Control Panel

Move the Run-Stop-Remote switch on the DC panel (Figure 2) to the RUN position. This will activate the engine control system and the starting system. The starter will begin cranking and after a few seconds the engine should start. The starter will disconnect when the engine reaches a speed of 450 to 570 r/min.

If the engine does not start, the starter will disengage after a specified period of time and the control will indicate an overcrank fault. Generator sets with the standard overcrank control will crank continuously for up to 75 seconds before disengaging the starter. Generator sets with the cycle cranking option will crank for 15 seconds and then stop for 15 seconds until 3 cycles have been completed. To clear an overcrank fault, place the Run-Stop-Remote switch in the STOP position and momentarily depress the Reset switch. Wait two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt at starting, refer to the Troubleshooting section.

Starting From Remote Location

Move the Run/Stop/Remote switch on the generator set DC panel to the REMOTE position. This allows the generator set to be started from a remote switch. Closing the remote switch initiates the starting sequence described in the previous section.

Automatic Starting

Place the Run/Stop/Remote switch on the generator set DC panel in the REMOTE position if an automatic transfer switch is used. This allows the transfer switch to start the generator set if a power outage occurs and stop it when the power returns.

STOPPING

Before Stopping

Run the generator set at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

To Stop

If the set was started at the set control panel or at a remote control panel, move the Run/Stop/Remote switch or remote starting switch to the STOP position. If the set was started by an automatic transfer switch, the set will automatically stop about 15 minutes after the normal power source returns.

BREAK-IN

Drain and replace the crankcase oil after the first 50 hours of operation on new generator sets. Refer to the Maintenance section of this manual for the recommended procedures.

NO-LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater element, etc.

EXERCISE PERIOD

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts and in general helps provide reliable engine starting. Exercise the generator set at least once a week for a minimum of 30 minutes with load so the engine reaches normal operating temperatures.

Onan automatic transfer switches have as an option an exerciser that can be preset to provide regular exercise periods. Typically the exerciser can be set for time of start, length of run, and day of week.

HIGH/LOW OPERATING TEMPERATURES

Use a coolant heater if a separate source of power is available. The optional heater available from Onan will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

CAUTION *To avoid damage to heater, be sure the cooling system is full before applying power to the heater.*

Use the table below as a general guide for performing periodic maintenance on Model ENT. Existing Table 3 can still be used for EN models.

TABLE 3A. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS					
	10	50	100	200	400	800
Inspect Complete Set	X ¹					
Check Engine Oil Level	X					
Check Radiator Coolant Level	X					
Check Fuel	X					
Check Governor Oil Level		X				
Check Electrolyte Level of Battery		X				
Lubricate Governor Linkage		X ²				
Check all Hardware, Fittings, Clamps, Fasteners, etc.		X ⁴				
Change Engine Oil & Filter			X ²			
Check Air Cleaner (Clean or Replace as Necessary)			X ²			
Adjust Drive Belt Tension				X ³		
Change Governor Oil				X		
Check Starter				X ⁵		
Clean & Inspect Battery Charging (DC) Alternator				X		
Check AC Generator				X		
Adjust Valve Clearances					X	
Replace Ignition Points						X
Replace Spark Plugs						X
Replace Coolant and Coolant Hoses	1500 Hours or 2 Years ⁶					
Replace Oil Cooler Hoses	1500 Hours or 2 Years ⁶					

1 - Visually and audibly inspect entire exhaust system for leaks.

2 - Perform more often in extremely dusty conditions.

3 - Adjust to 1/2-inch (13 mm) depression between pulleys. Refer to Ford engine manual.

4 - Or every 3 months.

5 - Oil front bearing sparingly; check brushes.

6 - Whichever comes first.

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Introduction

ABOUT THIS MANUAL

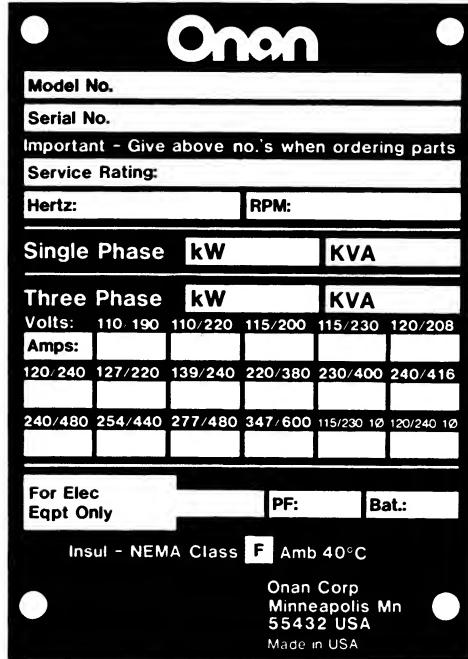
This manual provides general information for operating and maintaining your Onan generator set. Study this manual carefully and observe all warnings and cautions. Using the generator set properly and following a regular maintenance schedule will result in longer unit life, better performance, and safer operation.

Included with the generator set literature package is a copy of the Ford Operator's Manual for the engine. The engine manual may be used in conjunction with the generator set Operator's Manual. The operation and maintenance procedures for the complete generator set (including the engine) are covered in the EN Operator's Manual. In case of conflicting information, the EN Operator's Manual takes precedence over the engine manual.

HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact an Onan Distributor for assistance. Onan factory trained Parts and Service representatives are ready to handle all your service needs.

When contacting an Onan Distributor, always supply the complete Model number and Serial number as shown on the Onan nameplate (Figure 1). The Onan nameplate is located on the side of the generator control box.



M-1641

FIGURE 1. ONAN NAMEPLATE

WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY, DEATH AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

Specifications

TABLE 1. SPECIFICATIONS

SYSTEMS	60 EN	70 EN
Engine	Ford LSG 875-6005	Ford LSG 875-6005
Generator Onan 3 phase 60 Hz UR	60 kW (75 kVA @ 0.8 PF)	70 kW (87.5 kVA @ 0.8 PF)
Electrical System Starting Voltage	12 Volts DC	12 Volts DC
Coolant System Capacity (Standard Radiator)	7.5 gallons (28 L)	7.5 gallons (28 L)
Lubrication System Capacity (with filter)	9 quarts (8.5 L)	9 quarts (8.5 L)

Operation

GENERAL

This section covers starting and operating the generator set. It is recommended that the operator read through this entire section before attempting to start the set. It is essential that the operator be completely familiar with the set to provide safe operation.

PRESTART CHECKS

Before starting, be sure the following checks have been made and the unit is ready for operation. Refer to the Maintenance section for the recommended procedures.

Lubrication

Check the engine oil level. Keep the oil level near as possible to the dipstick high mark without overfilling.

Coolant

Check the engine coolant level. The coolant should be about two inches below the radiator cap opening. Do not check while the engine is hot.



Contact with hot coolant can result in severe burns. Do not bleed hot, pressurized coolant from a closed cooling system.

Fuel

Open all manual shutoff valves in the fuel supply system.

CONTROL PANEL

The following describes the function and operation of the standard generator set control. All instruments and control switches are located on the face of the control panel as illustrated in Figure 2. The control panel is separated into a DC panel for monitoring the engine and an AC panel for monitoring the generator.



EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- **Dizziness**
- **Nausea**
- **Headache**
- **Weakness and Sleepiness**
- **Throbbing in Temples**
- **Muscular Twitching**
- **Vomiting**
- **Inability to Think Coherently**

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

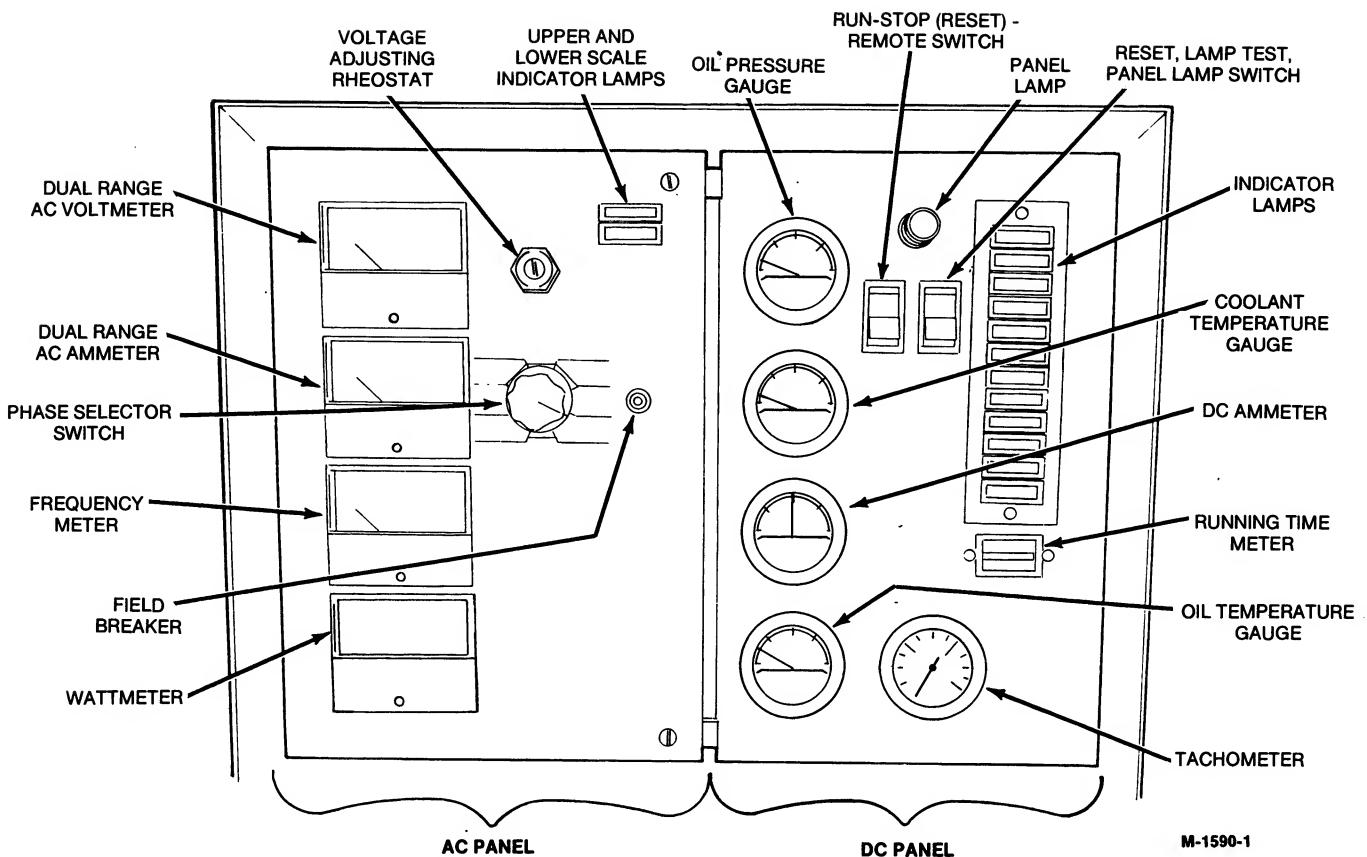


FIGURE 2. CONTROL PANEL

DC Panel:

Panel Lamp: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine (wired to a sensor unit located on the engine).

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run/Stop/Remote Switch: Starts and stops the unit locally, or from a remote location wired to the control engine monitor board.

Running Time Meter: Registers the total number of hours the unit has run. Use it to keep a record of periodic servicing. Time is cumulative; meter cannot be reset.

Reset, Lamp Test, Panel Lamp Switch: Resets the fault circuit only when the Run/Stop/Remote switch is in the Stop (Reset) position. Tests fault lamps and turns on the control panel lamp.

Tachometer (Optional): Provides constant monitoring of engine r/min.

Oil Temperature Gauge (Optional): Indicates temperature of lubricating oil in engine (wired to a sensor unit located on the engine).

Indicator Lamps: The standard control panel has two monitor system indicator lamps.

- RUN (green)
- FAULT (red)

The green Run lamp comes on as soon as the secondary starter circuit is opened after unit starting. The red lamp indicates an emergency shutdown of the generator set.

The optional control panel has a 12-lamp monitoring system. The following describes each lamp function.

- RUN (green) lamp comes on when both starter circuits are opened after unit starting.
- PRE LO OIL PRES (yellow) indicates engine oil pressure is marginally low.
- PRE HI ENG TEMP (yellow) indicates engine temperature is marginally high.
- LO OIL PRES (red) indicates engine has shut down because of critically low oil pressure.

- HI ENG TEMP (red) indicates engine has shut down because of critically high temperature.
- OVERSPEED (red) indicates engine has shut down because of excessive speed.
- OVERCRANK (red) indicates the starter has been locked out because of excessive cranking time.
- FAULT 1 (red) an undedicated fault. May be factory programmed as a shutdown or non-shutdown, and as a timed or non-timed (normally set for timed shutdown).
- FAULT 2 (red) same features as Fault 1 (normally set for non-timed shutdown).
- LO ENG TEMP (yellow) engine temperature is marginally low for starting. Indicates inoperative coolant heater. (Lamp lights when engine water jacket temperature is 70°F (21°C) or lower. Since the lamp goes out after the engine warms up there should be no cause for alarm even during initial generator set operation.)
- LO FUEL (yellow). Indicates fuel supply is marginally low.
- SWITCH OFF (flashing red) indicates generator set is not in automatic start operation mode.

AC Panel

AC Voltmeter (Optional): Dual range instrument indicating AC voltage. Measurement range in use shown on indicator light.

AC Ammeter (Optional): Dual range instrument indicates AC generator line current.

Wattmeter (Optional): Continuously gives reading of the generator output in kilowatts.

Frequency Meter (Optional): Indicates generator output frequency in hertz. It can be used to check engine speed (each hertz equals 30 r/min).

Voltage Adjust (Optional): Rheostat providing approximately plus or minus five percent adjustment of the rated output voltage.

Upper and Lower Scale Indicator Lamps (Optional): Indicates which scale to use on the AC voltmeter and ammeter.

Phase Selector Switch (Optional): Selects phases of generator output to be measured by AC voltmeter and AC ammeter.

Field Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of generator, exciter and voltage regulator.

CONTROL PANEL INTERIOR

Generator AC Voltage Regulator

The solid-state regulator (VRAS-2) controls AC output voltage from the generator at a predetermined level regardless of load. Voltage regulation is plus or minus two percent from no load to full load. Random voltage variation is plus or minus one percent for constant loads.

Engine Control Module

Electronic and relay components of the engine monitoring circuit are on a circuit board assembly. Sensor inputs (Figure 3) are connected by the wiring harness to plug connectors on the board. The control module provides the following functions of unit protection.

- Overcrank - Limits engine cranking to 75 seconds. If engine fails to start, the module lights a fault lamp and opens the cranking circuit. The cycle cranking option allows three 15-second cranking cycles with two 15-second rest periods on the 12-lamp control.
- Overspeed - Shuts down the engine immediately if overspeed occurs and lights a fault lamp. The sensor switch is mounted in the end bell on the generator shaft. It is factory adjusted to shut down 60 hertz units at 2100 ± 90 r/min, 50 hertz units at 1850 ± 50 r/min.
- Low Oil Pressure - Shuts down the engine immediately if oil pressure drops below 25 psi (172 kPa) and lights a fault lamp. The fault is time-delayed about 10 seconds following starter disconnect and inhibited during cranking. The delay allows oil pressure to rise to normal before the electronic control module monitors this system.

A pre-low oil pressure sensor and lamp (used with optional 12-lamp system) provides an alarm that oil pressure is marginally low, 30 psi (207 kPa) or less. The cause should be found and corrected as soon as possible.

- High Engine Temperature - shuts down the engine immediately if coolant temperature rises above 215°F (102°C) and lights a fault lamp. The fault is time-delayed about 10 seconds following starter disconnect and inhibited during cranking. This delay allows coolant in a hot engine time to circulate and return the water jacket to normal before the electronic control module monitors this system.

A pre-high engine temperature sensor and lamp used with optional 12-lamp systems, provides an alarm that engine temperature is marginally high, 205°F (97°C). The cause should be found and corrected as soon as possible.

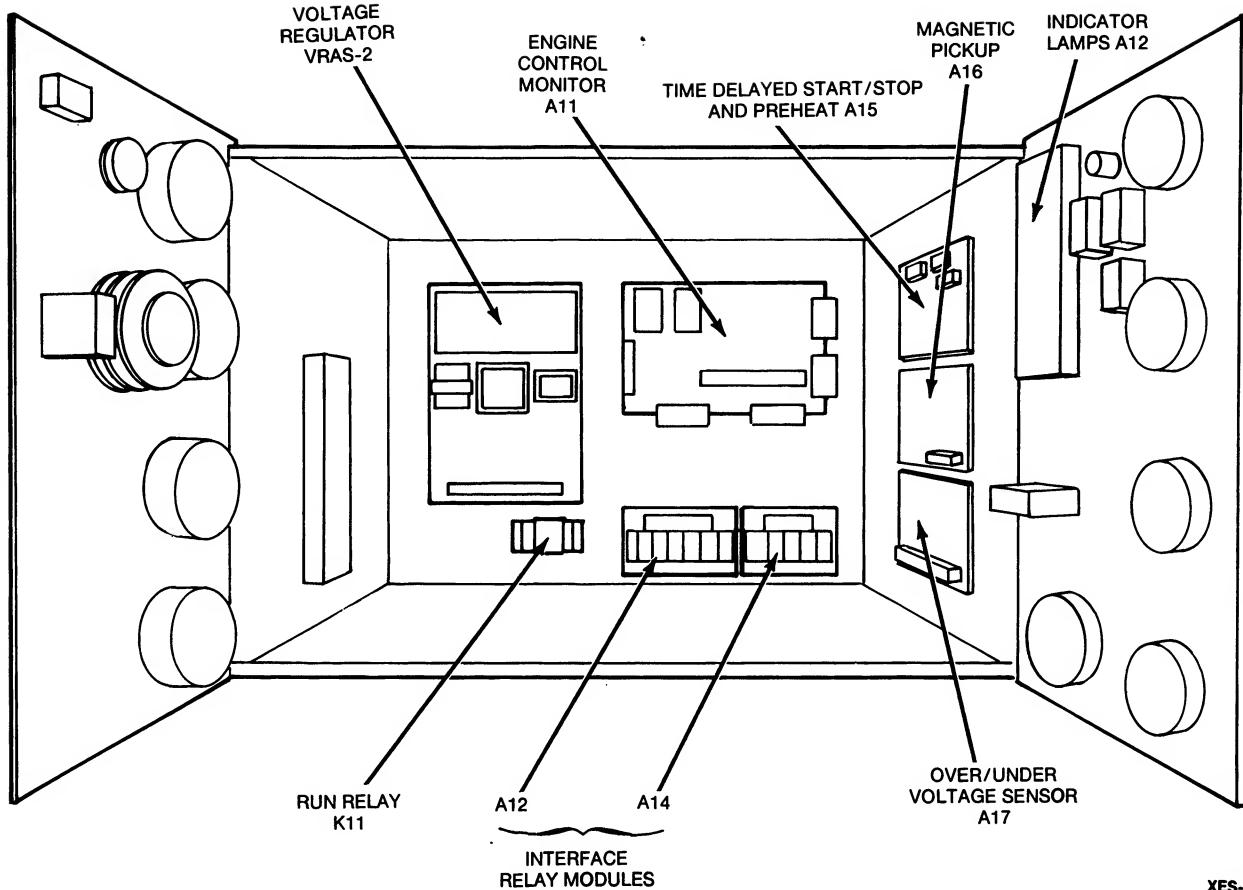


FIGURE 3. CONTROL PANEL INTERIOR

XES-1561

CAUTION

The high engine temperature shutdown system will shut down the engine in an overheat condition only if the coolant level is sufficiently high to physically contact the shutdown switch. Loss of coolant will allow the engine to overheat without protection of the shutdown system, thereby causing severe damage to the engine. Therefore, maintain adequate engine coolant levels to ensure the operational integrity of the cooling and overheat shutdown protection systems.

- Low Coolant Level Shutdown (If Used) - A capacitance switch provides engine shutdown if coolant level falls too low. It also turns on the high engine temperature fault lamp.

STARTING PROCEDURE

The following sections cover the three systems used to start the generator set.

Starting at Control Panel

Move the Run-Stop-Remote switch on the DC panel (Figure 2) to the RUN position. This will activate the engine control system and the starting system. The starter will begin cranking and after a few seconds the engine should start. The starter will disconnect when the engine reaches a speed of 450 to 570 r/min.

If the engine does not start, the starter will engage after a specified period of time and the control will indicate an overcrank fault. Generator sets with the standard overcrank control will crank continuously for up to 75 seconds before disengaging the starter. Generator sets with the cycle cranking option will crank for 15 seconds and then disengage for 15 seconds until 3 cycles have been completed. To clear an overcrank fault, place the Run-Stop-Remote switch in the STOP position and momentarily depress the Reset switch. Wait two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt at starting, refer to the Troubleshooting section.

Starting from Remote Location

Move the Run-Stop-Remote switch on the generator set DC panel to the REMOTE position. This allows the generator set to be started from a remote switch. Closing the remote switch initiates the starting sequence described in the previous section.

Automatic Starting

Place the Run-Stop-Remote switch on the generator set DC panel in the REMOTE position if an automatic transfer switch is used. This allows the transfer switch to start the generator set if a power outage occurs and stop it when the power returns.

STOPPING

Before Stopping

Run the generator set at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

To Stop

If the set was started at the set control panel or at a remote control panel, move the Run/Stop/Remote switch or remote starting switch to the STOP position. If the set was started by an automatic transfer switch, the set will automatically stop about 15 minutes after the normal power source returns.

OPERATING RECOMMENDATIONS

Some of the following sections require that a load be connected to the generator set. This is usually done using a load transfer switch. Refer to the transfer switch operator's manual for operation information.

No-Load Operation

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

Exercise Period

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts and in general helps provide reliable engine starting. Exercise the generator set at least once a week for a minimum of 30 minutes with load so the engine reaches normal operating temperatures.

Onan automatic transfer switches have as an option an exerciser that can be preset to provide regular exercise periods. Typically, the exerciser can be set for time of start, length of run, and day of week.

Low Operating Temperatures

Use a water jacket heater if a separate source of power is available. The optional heater available from Onan will provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

CAUTION *To avoid damage to heater, be sure the cooling system is full before applying power to the heater.*

Power Rating Factors

The generator set power rating applies to sets used in standby applications. The set will operate at the stated rating for the duration of normal utility power interruptions. The rating was established for a standard radiator cooled set running on gasoline and operating at an altitude of 300 feet (92 m) with an ambient temperature of 77°F (25°C). For a rating relative to other applications, altitudes, cooling systems, or ambient temperatures, contact an authorized Onan Distributor.

Troubleshooting

The generator set has a number of sensor units (Figure 4) that continuously monitor the engine for abnormal conditions such as low oil pressure or high coolant temperature. If an abnormal condition does occur, the engine monitor will activate a fault lamp and may also stop the engine depending on the condition. If the generator set does shut down, the operator may be able to restart the set after making certain adjustments or corrections. This section describes the operation of the fault condition system and suggested troubleshooting (Table 2) procedures for the operator.

The standard two light control has a single green light to indicate Run and a single fault light to indicate malfunctions. The optional 12 light control has a single green Run light, 4 amber pre-fault lights, and 7 red fault lights. Both controls also have a terminal connection for an external audible alarm which will sound when a fault occurs.

Safety Considerations

High voltages are present within the control box and generator output box when the generator is running. Do not open the control box or generator output box while set is running.

WARNING *Contacting high voltage components can cause severe personal injury or death. Keep control and output box covers in place during troubleshooting.*

Generator set installations are normally designed for automatic starting or remote starting. When troubleshooting a set that is shut down, make certain the

generator set cannot be accidentally restarted. Place the Run/Stop/Remote switch in the STOP position and remove the negative battery cable from the set starting battery.

WARNING *Accidental starting of the generator set during troubleshooting can cause severe personal injury or death. Disable the generator set before troubleshooting.*

When a fault comes on during operation, follow the procedures in Table 2 to locate and correct the problem. For any symptom not listed, contact an Onan Distributor for service.

Resetting the Control

The external alarm and fault lamp can be deactivated by placing the Run/Stop/Remote switch in the Stop position and pressing the Reset/Lamp Test switch. Locate the problem and make the necessary corrections before restarting the generator set. While pressing the Reset/Lamp Test switch, observe that all lamps light.

Line Circuit Breaker (Optional)

The optional line circuit breaker mounts on the generator output box. If the load exceeds the generator current rating, the line circuit breaker will open to prevent the generator from being overloaded. If the circuit breaker trips, locate the source of the overload and correct as required. Manually reset the breaker to reconnect the load to the generator.

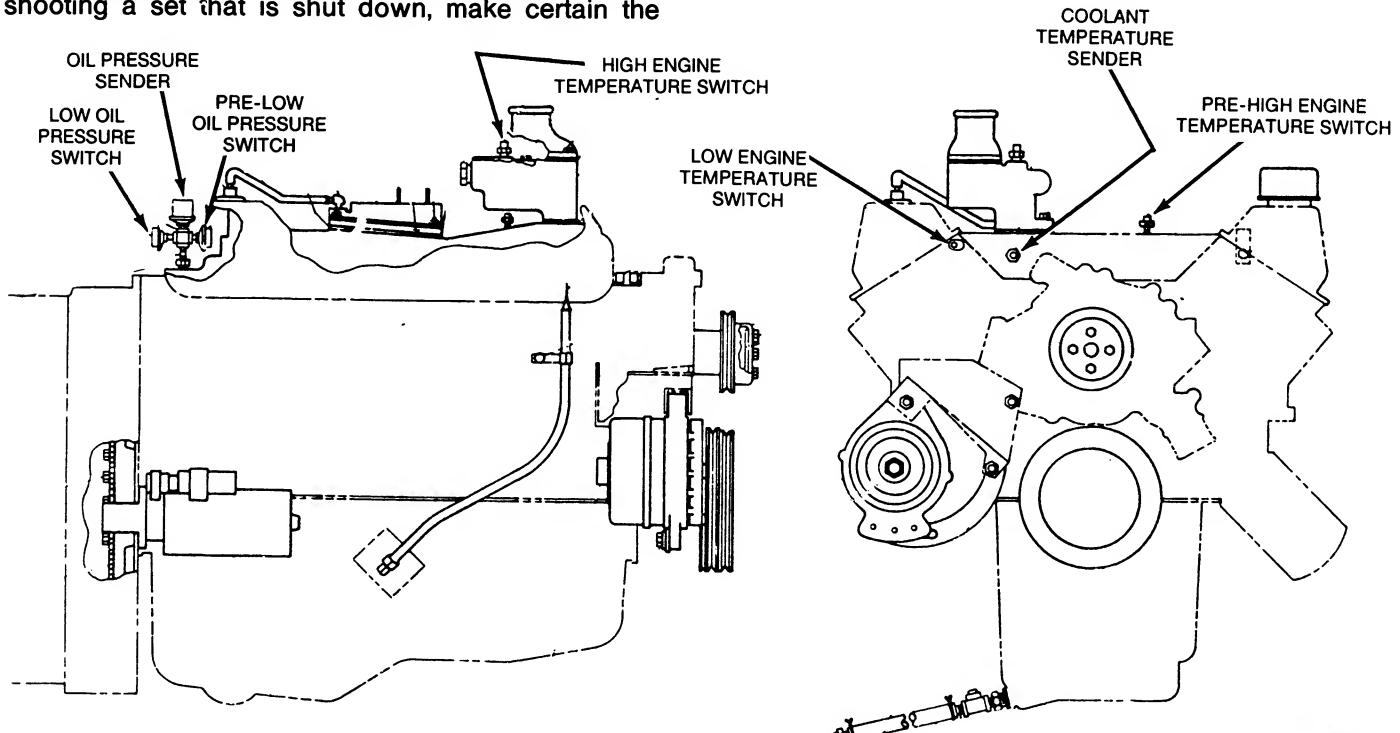


FIGURE 4. ENGINE SENSORS

TABLE 2. TROUBLESHOOTING

WARNING *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
*1. Green RUN lamp lights following engine start-up.	1. Indicates all engine systems are normal. No corrective action required.
2. PRE HI ENGINE TEMP lamp lights. Engine continues to operate.	2. Indicates engine has begun to overheat and engine temperature has risen to approximately 205°F (97°C). If engine can be stopped, follow procedures in step 3. Use the following procedures if generator is powering critical loads and cannot be shutdown. <ol style="list-style-type: none"> Check air inlets and outlets and remove any obstructions to airflow. Open doors or windows in generator area to increase ventilation. Reduce load if possible by turning off non-critical loads.
*3. HI ENG TEMP lamp lights. Engine shuts down.	3. Indicates engine has overheated (engine temperature has risen above 215°F/102°C or coolant level is low (sets with coolant level sensor). Allow engine to cool down completely before proceeding with the following checks: <ol style="list-style-type: none"> Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. Check for obstructions to cooling airflow and correct as necessary. Check for a slipping fan belt and tighten if loose. Reset control and restart after locating and correcting problem. Contact an Onan Dealer or Distributor if none of the above.
4. PRE LO OIL PRES lamp lights. Engine continues to operate.	4. Indicates engine oil pressure has dropped to 30 psi (207 kPa). If engine can be stopped, follow procedures in step 5. If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow step 5 procedure.
*5. LO OIL PRES lamp lights. Engine shuts down NOTE: See also step 6.	5. Indicates engine oil pressure has dropped to 25 psi (172 kPa). Check oil level and replenish if low. Reset control and restart. Contact an Onan Dealer or Distributor if oil pressure is not in the range of 30-55 psi (207 to 380 kPa).

*Use these steps when troubleshooting two light control panels.

Run Lamp - See steps 1 and 15

Fault Lamp - See steps 3,5,6,7 and 11.

Other Faults - See steps 12, 13 and 14.

TABLE 2. TROUBLESHOOTING (Continued)

WARNING *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel will have knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
*6. OVERCRANK lamp lights and engine stops cranking. or Engine runs, shuts down, and LO OIL PRES lamp lights.	6. Indicates possible fuel or ignition system problem. a. Check fuel leaks, or plugged fuel lines and correct as required. b. Check for dirty fuel filter and replace if necessary (see MAINTENANCE section). c. Check for dirty or plugged air filter and replace if necessary (see MAINTENANCE section). d. Check for loose connections in the ignition primary, ignition secondary, or solenoid valve circuits and correct as required. e. Reset the control and restart after correcting the problem. Contact an Onan Dealer or Distributor for service if none of the above.
*7. Engine runs and then shuts down, OVERSPEED lamp lights.	7. Indicates engine has exceeded normal operating speed. Contact an Onan Dealer or Distributor for service.
8. SWITCH OFF lamp flashes.	8. Indicates Start/Stop/Remote switch is in the Stop position which will prevent automatic starting if an automatic transfer switch is used. Move the Start/Stop/Remote switch to the Remote position for automatic starting.
9. LO ENG TEMP lamp lights. Set is in standby mode but is not operating. (Lamp lights when engine water jacket temperature is 70°F (21°C) or lower. Since the lamp goes out after the engine warms up, there should be no cause for alarm even during initial generator set operation.)	9. Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions: a. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. Contact an Onan Dealer or Distributor if none of the above.
10. The FAULT 1 or FAULT 2 fault lamp lights. Engine shuts down immediately, engine runs for several seconds and then shuts down, or engine continues to run.	10. The standard undesignated fault functions are programmed to shut down the set when a fault is sensed. Fault 1 is timed delay while Fault 2 is immediate. The nature of the fault is an optional selection that is determined when the set installation is designed. The undesignated fault functions may also be programmed for non-shutdown or non time delay.
*11. Fault lamp lights but no fault exists, Engine gauges show oil pressure, engine temperature, and frequency (speed) are within normal limits.	11. Reset control. If control will not reset, the monitor board or a sensor may be at fault. Contact an Onan Dealer or Distributor for service.

*Use these steps when troubleshooting two light control panels.

Run Lamp - See steps 1 and 15.

Fault Lamp - See steps 3,5,6,7 and 11.

Other Faults - See steps 12, 13 and 14.

TABLE 2. TROUBLESHOOTING (Continued)

WARNING *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
*12. Engine Starts from generator control panel but will not automatically or from a remote panel (Note: The Start/Stop/Remote switch must be in the Remote position for automatic or remote starting).	12. Remote circuit breaker is tripped. Reset breaker and restart. Contact an Onan Dealer or Distributor if breaker trips after resetting.
*13. Engine will not crank.	13. Indicates possible fault with control or starting system. Check for the following conditions: a. Fault lamp on. Correct fault and reset control. b. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. c. Discharged or defective battery. Recharge or replace the battery. d. Contact an Onan Dealer or Distributor for assistance if none of the above.
*14. No AC output voltage.	14. Field breaker is tripped. Reset breaker. Contact an Onan Dealer or Distributor if voltage build up causes breaker to trip.
*15. Green RUN lamp does not light following engine start-up.	15. Indicates possible Start/Disconnect relay failure. Contact an Onan Dealer or Distributor for assistance.

*Use these steps when troubleshooting two light control panels.

Run Lamp - See steps 1 and 15.

Fault Lamp - See steps 3,5,6,7 and 11.

Other Faults - See steps 12,13, and 14.

Maintenance

Establish and follow a definite schedule for maintenance and service based on the application and severity of the environment. The table below covers the recommended service intervals for a generator set on STANDBY service. If the set will be subjected to extreme operating conditions, the service intervals should be reduced accordingly. Some of the factors that can affect the maintenance schedule are the following:

- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand

Consult with an authorized Onan Distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated or after the number of operating hours indicated, whichever comes first. Use the table to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

WARNING

Accidental starting of the set while performing maintenance procedures can cause severe personal injury or death. Place the Run-Stop-Remote switch in the STOP position and disconnect the negative (-) battery cable from the battery terminal before beginning maintenance procedures.

TABLE 3. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS				
	10	100	200	300	400
Inspect Complete Set for Exhaust & Fuel Leaks, etc.	x1				
Check Engine Oil Level	x1				
Check Radiator Coolant Level	x1				
Check Air Cleaner (Clean or Replace as Necessary)		x2			
Check Electrolyte Level of Battery		x6			
Lubricate Governor Linkage		x2			
Change Engine Oil & Filter		x2			
Check all Hardware, Fittings, Clamps, Fasteners, etc.		x4			
Adjust Drive Belt Tension			x3		
Check Starter			x5		
Clean & Inspect Battery Charging (DC) Alternator			x		
Check AC Generator			x		
Check Governor Frequency Setting				x	
Adjust Valve Clearances					x

x1 - As noted or after every run.

x2 - Perform more often in extremely dusty conditions.

x3 - Adjust to 1/2-inch (12.5 mm) depression between pulleys.

x4 - Or every 3 months.

x5 - Oil front bearing sparingly; check brushes.

x6 - Or every two weeks.

NOTE: The above schedule is a minimum requirement.

GENERATOR SET INSPECTION

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover several areas that should be frequently inspected to help provide continued safe operation.

Engine Gauges

Check the following while the generator set is operating.

Oil Pressure Gauge: The oil pressure should be in the range of 30-55 psi (207-380 kPa) when the engine is at operating temperature.

Water Temperature Gauge: The water temperature should be in the range of 165° to 195°F (74° to 91°C) depending on the load and ambient temperature.

DC Ammeter: The maximum charge rate for the set mounted battery charging alternator is 35 amperes. Charge rate should taper to zero following start-up as battery becomes charged.

AC Meters (If Equipped)

Check the following while the generator set is operating.

Frequency Meter: The generator frequency should be stable and the reading should be the same as the nameplate rating (50 or 60 Hertz).

AC Voltmeter: Turn the phase selector switch to each line-to-line phase selection shown on the Volts scale (L1-L2 on single phase sets; L1-L2, L2-L3, and L3-L1 on three phase sets). Read the AC voltmeter using the upper or lower scale as indicated by the scale indicator light. At no load, the line-to-line voltage(s) should be the same as the set nameplate rating.

AC Ammeter: Turn the phase selector switch to each phase selection shown on the Amps scale (L1 and L2 on single phase sets; L1, L2, and L3 on three phase sets). Read the ammeter using the upper or lower scale as indicated by the scale indicator light. At no load, the current readings should be zero. With a load applied, each line current should be roughly the same and no line current should exceed the set nameplate rating.

Engine Monitor Indicator Lights

Hold the Reset/Lamp Test switch in the Test position. All indicator lamps (except Run) should light. Verify that all of the bulbs are on and then release the switch. Contact an Onan Distributor if any bulbs require replacement.

Exhaust System

With the generator set operating, inspect the entire exhaust system including the exhaust manifold, muffler, and exhaust pipe. Visually and audibly check for leaks at all connections, welds, gaskets, and joints and also make sure that exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, have them corrected immediately.

WARNING *Inhalation of exhaust gases can result in serious personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Shut down the set and repair any leaks immediately.*

Fuel System

With the generator set operating, inspect the fuel supply lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and make sure they are not rubbing against anything that could cause breakage.

WARNING *Leaking fuel will create a fire hazard which can result in severe personal injury or death if ignited by a spark, cigarette, pilot light, flame, etc. If any leaks are detected, shut down the set and have them corrected immediately.*

DC Electrical System

With the generator set off, check the terminals on the battery for clean and tight connections. Loose or corroded connections create resistance which can hinder starting. Clean and reconnect the battery cables if loose. Always connect the negative battery cable last to reduce the possibility of arcing.

WARNING *Ignition of explosive battery gases can cause severe personal injury. Do not smoke while servicing batteries.*

Mechanical

With the generator set stopped, check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, have them corrected immediately. With the set running, listen for any unusual noises that may indicate mechanical problems and check the oil pressure frequently. Investigate anything that indicates possible mechanical problems.

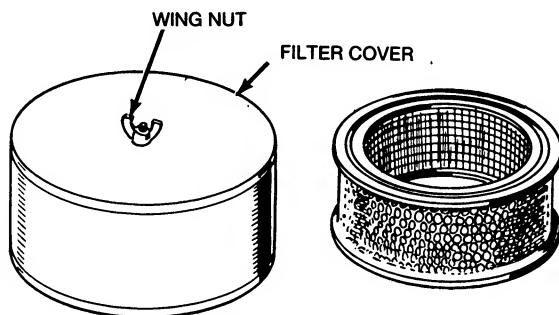
ENGINE

Air Filter

Remove wing nut in center of filter cover. See Figure 5. Remove cover and filter. Tap filter on a flat surface to remove adherent dirt. Place a light source inside the filter and inspect for free air passage. If necessary, apply a low pressure air source (30 psi [207 kPa] OSHA) to the inside of the filter to remove as much dirt as possible. Inspect interior housing. Vacuum clean if dirty, or remove housing and wipe clean.

CAUTION *Do not clean filter housing while still installed. Loose dirt entering intake could damage carburetor or engine.*

Replace air filter every 100 hours of operational time, more often in extremely dusty conditions.



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FIGURE 5. AIR CLEANER

Engine Oil Filter

Replace the oil filter at every oil change.

Remove and discard old filter, wipe oil from exposed adapter recess. See Figure 6. Coat gasket of new filter with clean lubricating oil and place in position on adapter. Hand-tighten filter until gasket contacts adapter face, then advance one-half turn. DO NOT OVERTIGHTEN.

Clean all oil residues from engine, then fill crankcase. Run engine and check for oil leaks; make necessary repairs. Note oil change in engine logbook.

USE THESE SAE VISCOSITY GRADES						
			SAE 40			
	SAE 10W					
TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE						
°F	-10	20	32	50	80	100
°C	-23	-7	0	10	27	38

LS-1162



LS-1169

FIGURE 6. OIL FILTER ASSEMBLY

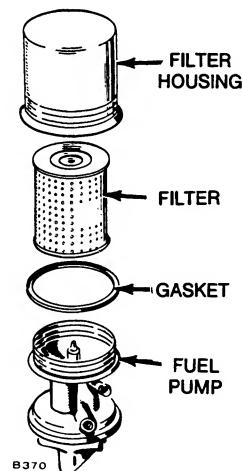
Fuel Filter

Replace filter every 200 operational hours or as conditions require. Unscrew the filter housing from the fuel pump (Figure 7) and remove the filter element and gasket. Discard the element and gasket. Clean the filter housing in a petroleum cleaning solvent.

Place a new filter element over the spout in the fuel pump valve housing cover.

Be sure to use the proper type element for the installation.

Coat a new gasket with a light engine oil and position the gasket on the filter housing. Screw the filter housing onto the fuel pump. Hand tighten the filter housing until the gasket contacts the pump, and then advance it 1/8 turn. Start the engine and check for leaks.



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FIGURE 7. FUEL FILTER ASSEMBLY

Crankcase Ventilation (PCV) Valve

Push fit in valve rocker cover. Remove and clean at every oil change. After cleaning, shake valve to ensure ball is free, then reinstall.

CARBURETORS

The following carburetors were installed by ONAN for a specific application and engine output. Use these instructions and adjustment procedures in preference to those given in the Ford engine manual.

Carburetor, Gasoline

Carburetors have fixed main jets and an adjustable idle circuit. The idle adjusting needle, on the side of the carburetor, affects operation at light and no load conditions. For location of adjustment see Figure 8.

Under normal circumstances, factory carburetor adjustments should not be disturbed. If adjustments have been changed, an approximate setting of 1-1/2 turns open for the idle needle will permit starting. Adjust temporarily for smoothest running. Allow engine to thoroughly warm up before making final adjustment.

To adjust "idle" (no load) needle, see that no loads are connected to the generator. Slowly turn idle adjusting needle out until engine speed drops slightly. Turn needle in just to the point where speed returns to normal.

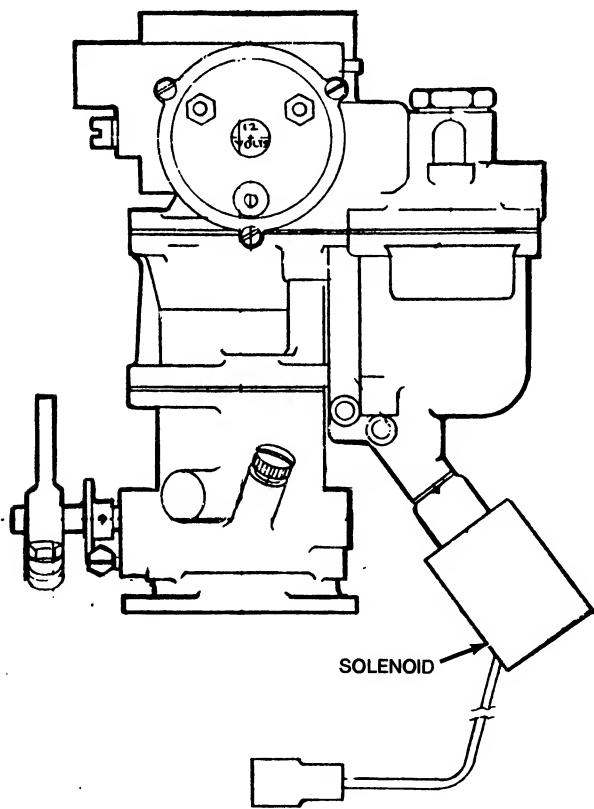


FIGURE 8. GASOLINE CARBURETOR

Combination Carburetor, Gas Operation

If the engine is equipped with a combination carburetor (Figure 9) be sure the manual gasoline shutoff valve is closed and the fuel toggle switch is in the gas position. The electric choke must be adjusted so the cover is turned 10 to 12 notches counterclockwise from the "*" mark. When properly adjusted the electric choke will be completely open even at very low temperatures.

Gas fuel main jet adjustment should be made at full load only.

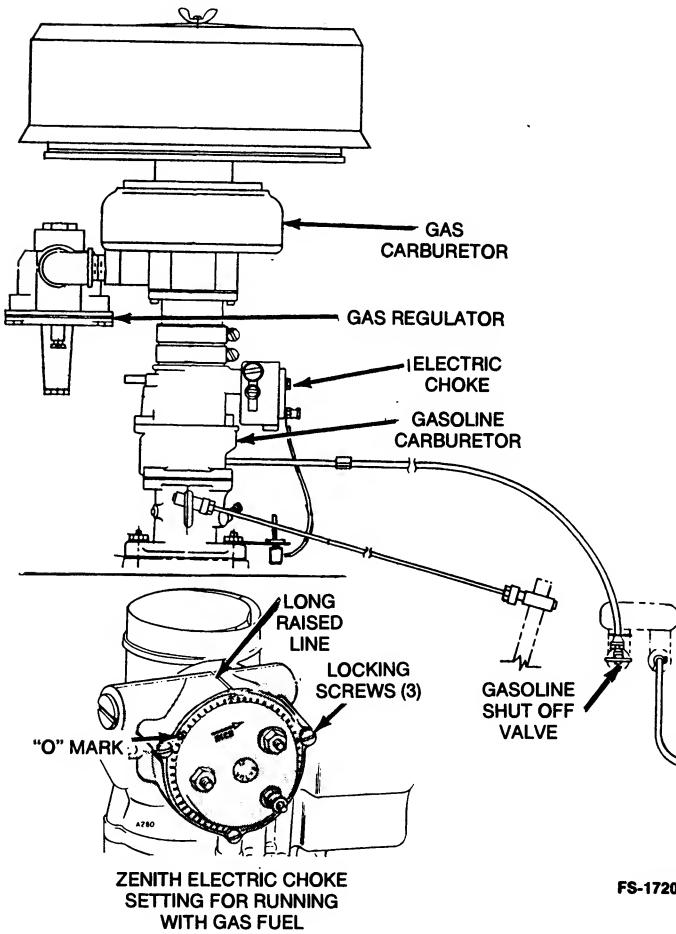
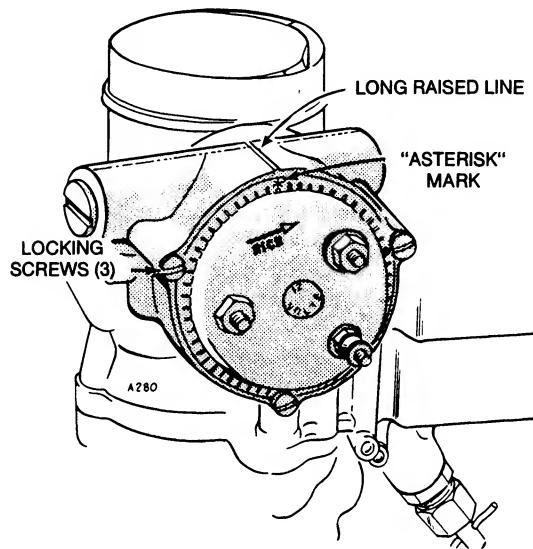


FIGURE 9. COMBINATION CARBURETOR

Electric Choke

A 12 volt electric choke (Figure 10) is used on all engines. The adjustable choke cover is held in place by three screws. Perimeter of the cover is divided into sections by small raised marks. One mark is labeled zero and the twelfth mark from zero is labeled with an asterisk (*), which indicates normal adjustment setting. A long raised line on top of the choke housing is used as the reference mark. Normal setting for the choke is made when the asterisk mark lines up with reference line.

If overchoking occurs, loosen three locking screws and turn choke cover slightly to the left (counterclockwise). Do not turn very far. One or two notches will usually be sufficient. Tighten locking screws. To increase choking action, turn choke cover slightly to the right (clockwise). Retighten cover screws.



FS-1721

FIGURE 10. ELECTRIC CHOKE

Carburetor, Gas

Engines equipped for natural gas operation use a gas carburetor with combined regulator. Carburetor adjustments are the same as the combination gas-gasoline carburetor. See Figure 9.

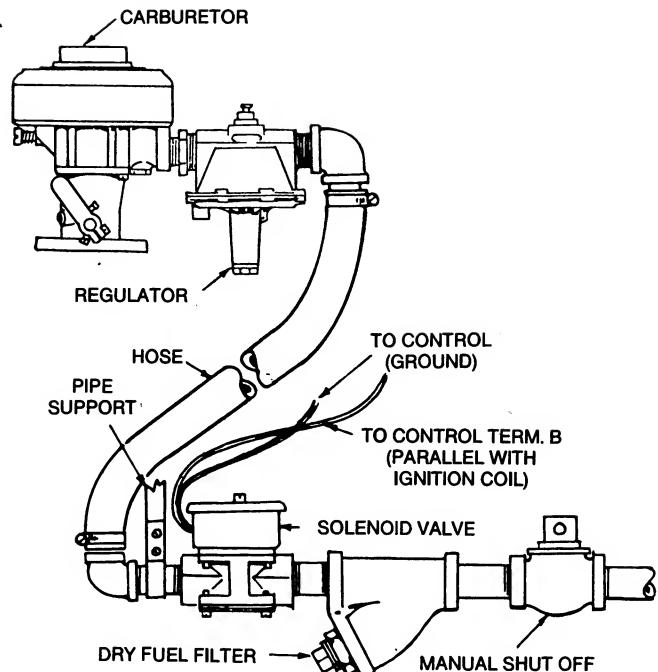


FIGURE 11. LPG VAPOR WITHDRAWAL

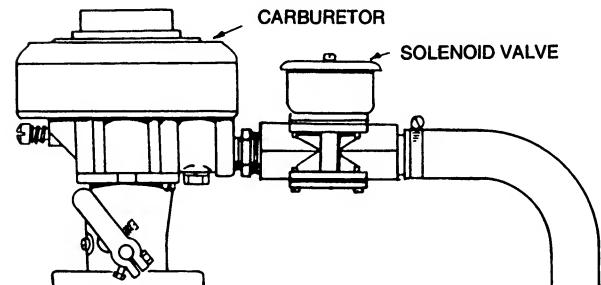
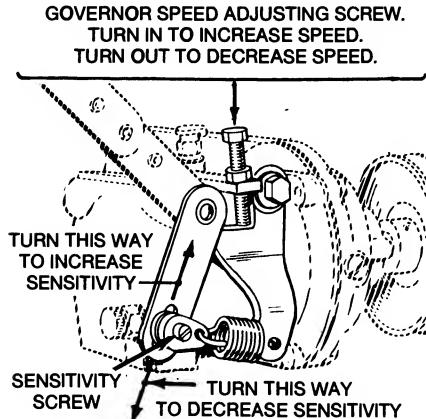


FIGURE 12. LPG LIQUID WITHDRAWAL

GOVERNOR

The governor controls the speed of the engine, and therefore the frequency of the voltage. Engine speed affects AC output voltage. Use either a tachometer or frequency meter to check engine speed for proper governor adjustment. See Figure 13.

- 1. Governor linkage**—With engine speed stopped, throttle held wide open, and tension on governor spring, adjust the governor linkage length by rotating the ball joint on the link so that the throttle stop lever clears the stop pin by not less than 1/32-inch.
- 2. Warm up**—Start the engine and allow it to reach operating temperature.
- 3. Speed**—With no electrical load connected, adjust the speed adjusting screw to obtain 1890 r/min (63 hertz). Apply a full electrical load. The speed drop from the no load figure should be no more than 90 r/min (3 hertz) and no less than 45 r/min (1-1/2 hertz). An incorrect speed drop from no load to full load necessitates a sensitivity adjustment.
- 4. Sensitivity**—If engine tends to hunt (alternately increase and decrease speed) under load conditions, increase sensitivity screw on which the spring link pivots. Any change in the setting of the sensitivity screw will require correcting the speed screw adjustment. Turning the sensitivity screw clockwise causes a slight speed increase which can be corrected by turning the speed screw slightly counterclockwise to decrease spring tension.
- 5. General**—Be sure that all lock nuts are tightened as adjustments are completed. Governors cannot operate properly if there is any binding, sticking, or excessive looseness in the connecting linkage or carburetor throttle assembly. A lean fuel mixture, or a cold engine may cause hunting.
- 6. Output**—Check the AC output voltage.



FS-1718

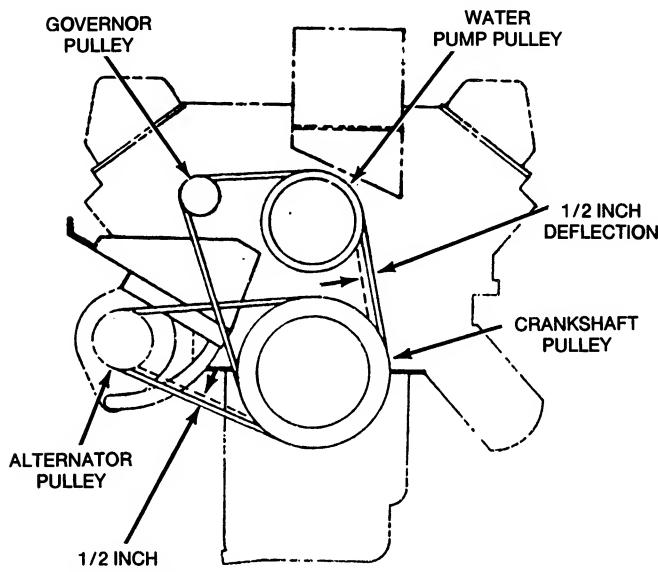
FIGURE 13. GOVERNOR ADJUSTMENT

DRIVE BELT ADJUSTMENT

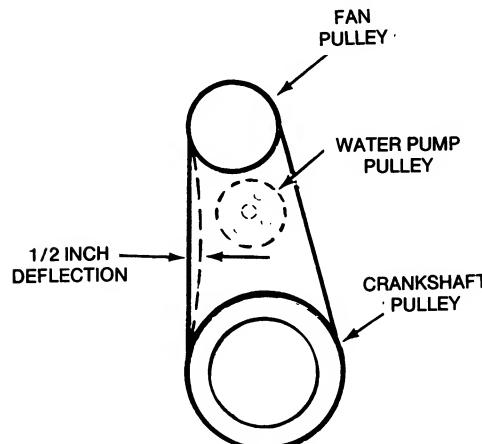
Belts are used to drive fan, governor and alternator (Figure 14). Maintain correct adjustment of these belts to provide proper engine cooling and alternator output. Check belts for cracks and wear occasionally, and replace when necessary.

To adjust fan, loosen fan bracket screws, then move bracket up or down until a deflection of 1/2 inch (13 mm) is obtained between crankshaft pulley and fan pulley, with light thumb pressure on the belt.

To adjust alternator or governor belt, loosen link clamp screw and the mounting bolts, move alternator toward or away from engine until a deflection of 1/2 inch (13 mm) is obtained between pulleys, with light thumb pressure on belt.



M-1703



M-1702

FIGURE 14. DRIVE BELT ADJUSTMENT

AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will provide good performance.

Inspection

Inspect generator and control box for loose or broken wires and parts. Check diodes and printed circuit boards for excessive dust, grease or moisture. Blow these assemblies out periodically with filtered, low pressure, compressed air.

CAUTION *Excessive foreign matter on diodes and heat sinks will cause overheating and possible failure.*

Generator Bearing

Inspect the bearing for evidence of outer case rotation every 1000 hours while the unit is running.

If unit is used for "prime power," replace the bearing every 10,000 hours or two years. If the unit is used for "standby," replace the bearing every five years.

Deterioration of the bearing grease due to oxidation makes this replacement necessary.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of grease will retard corrosion at terminals. Keep the electrolyte at the proper level above the plates by adding distilled water.

TUNE UP

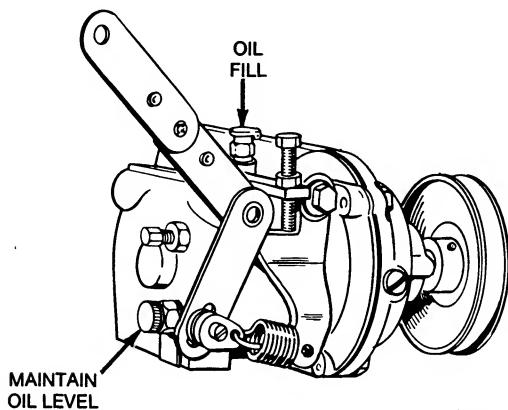
ONAN suggests that the following specifications for tune up be used in preference to those given in the Ford manual. This is due to a difference in r/min (no idle speed) and removal of automatic vacuum advance.

TABLE 4. TUNE-UP SPECIFICATIONS

ADJUSTMENTS	
Spark Plug Gap	0.035 inch (0.88 mm)
Spark Plug Torque	10-15 lbs ft (13.56-20.34 N•m)
Valve Clearance Setting	Zero Lash

GOVERNOR OIL

Governor oil level should be even with bottom of the oil level plug. When adding oil to the governor, the oil should just start to flow out of the oil level plug hole. Do not overfill. See Figure 15.

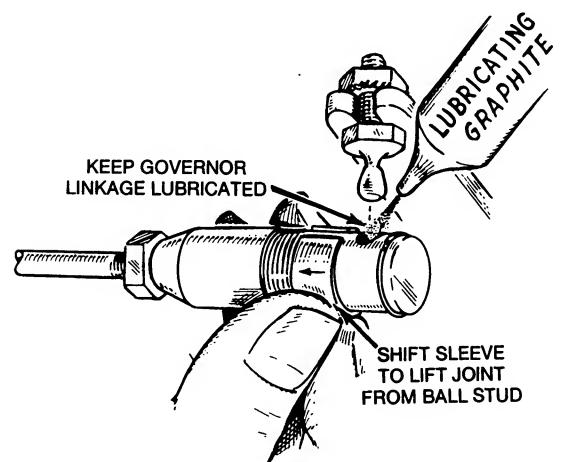


FS-1715

FIGURE 15. GOVERNOR OIL

GOVERNOR LINKAGE

Control linkage ball joint should be kept lubricated with graphite. If ball joint is neoprene, do not lubricate. See Figure 16.



FS-1714

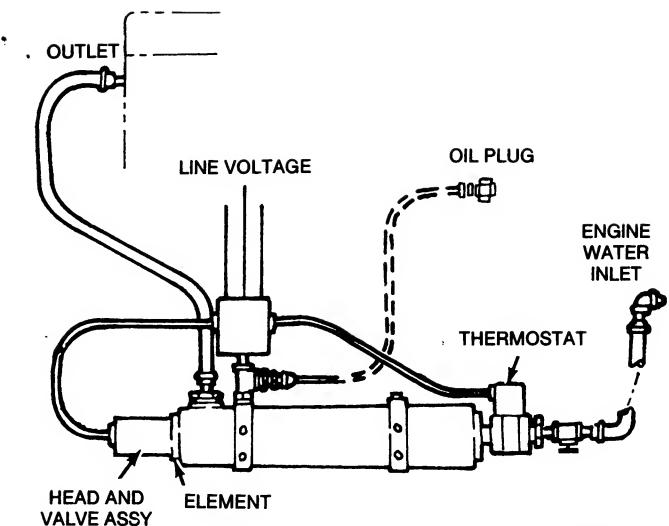
FIGURE 16. GOVERNOR LINKAGE

TANK HEATERS (Optional)

A Kim Tank Heater is optional equipment on the EN generating set. For efficient operation and optimum product life, perform the following procedure at least once a year (see Figure 17):

1. Remove head and valve assembly.
2. Clean foreign matter out of the tank.
3. Remove element and scrape off scale accumulated on the sheathing.

CAUTION *To avoid damage to heater, be sure the cooling system is full before applying power to the heater.*



CS-1322

FIGURE 17. ENGINE HEATER



Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432 (612) 574-5000

Telex 29 0476 (U.S.)
Telex 29 0856 (outside U.S.)
TWX 910 576-2833
Cable ONAN